

CLAIMS

1. Process for displaying, measuring the size and counting individual inclusions in suspension in a moving liquid metal (7), using a sensor comprising at least one means (1) of emitting a series of ultrasound beam pulses within the said liquid metal, at least one means (2) of receiving echoes reflected by the said inclusions, and their accessories, characterized in that it comprises a sensor response calibration step, the said step comprising using at least one control reflector (10) with known dimensions and stable with time, successive steps for the acquisition and processing of reflected echoes, a display step and an image analysis step to count and measure the diameter of inclusions.

2. Process according to claim 1, characterized in that each control reflector is a rod.

3. Process according to claim 2, characterized in that the end of the said rod has a flat surface.

4. Process according to claim 1, characterized in that the calibration step is carried out by introducing plurality of control reflectors that are inert with respect to the liquid metal, with calibrated diameters in the focal spot (9) formed by the intersection of ultrasound beams emitted and received by the said means (1, 2).

5. Process according to claim 4, characterized in that the said plurality of control reflectors is a set of rods.

6. Process according to claim 5, characterized in that at least the end of the said rods immersed in the said focal spot has a flat surface.

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7. Process according to any one of claims 1 to 6, characterized in that the frequency of the ultrasounds is between 0.5 and 50 MHz, and preferably between 5 and 50 MHz.

5        8. Device for implementing the process for analysis of inclusions contained in a liquid metal flow according to any one of claims 1 to 7, characterized in that it comprises an ultrasound sensor comprising at least one emission means (1), at least one reception  
10 means (2) and their accessories, at least one control reflector, a reflected ultrasounds echo acquisition and processing device, a display device for the said inclusions and an image analysis device to count them and measure their diameter.

15        9. Device according to claim 8, characterized in that each control reflector has a rod with a known diameter.

10        10. Device according to claim 9, characterized in that the end of the said rod has a flat surface.

20        11. Device according to claim 8, characterized in that the said at least one control reflector comprises a set of rods with known diameters.

12. Device according to claim 11, characterized in that the diameters of the said rods are different.

25        13. Device according to claim 11 or 12, characterized in that one end of the said rods has a flat surface.

14. Device according to any one of claims 8 to 13, characterized in that each emission means is an  
30 emitting probe and that each reception means is a receiving probe.

15. Device according to any one of claims 8 to 13, characterized in that the said at least one emission

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means and the said at least one reception means are grouped in an emission/reception probe capable of performing the emission and reception functions.

16. Device according to any one of claims 8 to 15,  
5 characterized in that it comprises ultrasound sensor means to probe the entire width of the liquid metal flow.

17. Device according to claim 16, characterized in that it comprises several emission and reception means  
10 with their delay line, side by side or staggered through the liquid metal flow.

18. Device according to claim 16, characterized in that it comprises a sensor having the width of said flow and in which each emission and reception means  
15 comprises a multi-element translator comprising several contiguous piezoelectric transducers prolonged by a delay line that is also adapted to the flow width of the liquid metal.

19. Device according to claim 18, characterized in  
20 that it comprises an electronic emission and reception control to scan and focus the acoustic beam.

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